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Journal of Oil and Fat Industries

Devoted to Oils, Fats and Allied Industries

VOL. III AUGUST, 1926 No. 8

EDITORIAL

AN OPPORTUNITY AND A TEST

For many years, too many in our opinion, the major oil crushing business of this country has been conducted as a purely speculative venture. Little attention has been paid to the real value of its raw material on the day of purchase. To even up blind buying, dockages on receipt of seed at mill were resorted to on no definite and preunderstood plan. It was dock the shipper all it was thought he would stand. In many cases, this was exceedingly heavy, but even then it was not enough to cover poor quality and speculative loss. There was no incentive to the producer to preserve and deliver high grade seed.

For several years, there has been evident a changing condition, and it now seems that the industry is awakening.

Opportunity is said to knock only once on each man's door to prosperity or fame. Reasoning along the same lines, is it not equally true that opportunity comes to a profession only once? Fail, and the profession is done—at least for the present personnel. Success, on the other hand, will open a field for the chemist of the broadest and most fertile kind.

The chemists of the cottonseed oil industry are on trial. Will they stand the test? Will they allow supposed present small business or personal advantages to dim their vision to the greater opportunities? Now is the time for wholehearted team work. Now is the time to show that the first requisite of a *manufacturing* business is to know what it is buying and its value—to be fair to seller as well as buyer. Proper seed grading is the opening wedge to thorough chemical control of all mill operations, the raising of standards of quality and uniformity. Sure profits not speculative hopes for all.

THE CHEMICAL COMPOSITION OF RICE OIL

By GEORGE S. JAMIESON

Rice oil, which has been produced on a small commercial scale from the bran at various times in England, Italy, and in this country in Louisiana, has been the subject of several investigation.[1, 2, 3] C. A. Browne,[4] who suggested the present study, determined the chemical and physical characteristics of the oil and demonstrated that rapid hydrolysis which the oil undergoes was due to a lipase. He fed rice bran and polish to steers and found that the feces contained considerable quantities of undigested fat and fatty acids. The insoluble fatty acids obtained in the usual manner had a mean molecular weight of 320.2, which is higher than that of arachidic acid (312.3).

Although in 1903 Browne had shown that rice oil contained fatty acids with a molecular weight greater than that of palmitic acid, Tsujimoto[6] stated that the oil which he examined contained palmitic, oleic and linolic acids. It will be shown that rice oil also contains myristic, stearic, arachidic and lignoceric acids.

The oil used in this investigation was extracted from rice bran by ethyl ether and given to the writer by Charles E. F. Gersdorff of the Protein Investigation Laboratory of this Bureau.

Chemical and Physical Characteristics

The characteristics of rice oil which were determined given in Table I. The percentages of saturated and unsaturated acids were determined by the lead salt ether procedure. The saturated acids as determined had an iodine number of 4.8 and contained 0.78 per cent of unsaponifiable matter for both of which corrections have been made.[7] Also unsaturated acids have been corrected for the 5.63 per cent of unsaponifiable matter which they contained.

Table I—CHARACTERISTICS OF RICE OIL

Refractive index 25°C	1.4690
Acid value	73.67
Iodine number (Hanus)	99.9
Saponification value	185.3
Saponification value corrected for unsaponifiable	194.2
Unsaponifiable matter (per cent)	4.64
Saturated acids (corrected) (per cent)	14.70
Unsaturated acids (corrected) (per cent)	74.30
Reichert-Meissl value	0.3
Polenske value	0.3

The acid value was determined about 2 weeks after the extraction of the oil. Both the iodine number and saponification value are in close agreement with the values obtained by Garelli for extracted rice oil.[8]

Unsaponifiable Matter

The unsaponifiable matter (3.8 g.) was separated from about 200 g. of the oil by the modified Kerr-Sorber method.[9] It was dissolved in 50 cc. of absolute alcohol and allowed to stand over night in a cool place. A small crop of colorless flat prisms were obtained. After recrystallization from alcohol, they melted at 83° C. When mixed with an equal quantity of melissyl alcohol (M. P. 84-5) the mixture melted at 83 to 84° C., indicating that the substance was melissyl alcohol. The quantity separated was too small for further identification tests.

After concentrating the alcoholic filtrate to about 35 cc. and allowing it to stand over night in the ice box, 0.4 gram of small brilliant crystals was obtained. This substance after recrystallization from alcohol melted at 137 to 138° C. without decomposition. It gave the Liebermann-Burchard test, showing that it was a phytosterol. The purified acetyl derivative melted at 124° to 125° C. Further concentration of the original alcoholic solution and cooling for several days failed to yield any more crystals. The concentrated solution was heated with 25 cc. of 95 per cent alcohol and a slight excess of a one per cent alcoholic solution of digitonin was added. One gram of the digitonin-sterol compound was obtained, which was equivalent to 0.24 g. of sterol. The total quantity of sterol isolated amounted to 16.7 per cent of the unsaponifiable matter.

The alcoholic filtrate was evaporated and the residue taken up in 30 cc. of ether. The insoluble digitonin was removed by filtration. The ether was evaporated and the residue was dissolved in 25 cc. of 95 per cent alcohol. After standing in the ice box for over 2 weeks, some brown crystalline aggregates, which had separated, were removed and recrystallized first from ether, then from alcohol. The purified substance melted at 138 to 139° C. The acetyle derivative was prepared. It melted at 132 to 132.5° and gave an intense Liebermann-Burchard test, indicating that it was not a dihydrosterol. The alcoholic filtrate, after concentration, deposited a small quantity of a sterol which melted at 142 to 143° C. This also gave the Liebermann-Burchard test. The quantity of this sterol was too small for the preparation of the acetyl derivative.

It was found that when a dilute alcoholic solution of either of these sterols was treated with an alcoholic one per cent solution of digitonin and allowed to stand, no precipitation took place. However, upon rubbing the sides of the flask with a rod, a copious precipitate of the digitonin-sterol compound quickly separated. Presumably, if the original alcoholic solution of the unsaponifiable matter after the addition of the digitonin solution had been thoroughly rubbed with a rod, a complete precipitation of the sterols would have been obtained. This experiment indicates that

similar treatment should be made in other cases when it is desired to completely precipitate the sterols with digitonin.

The total quantity of sterols isolated amounted to about 25 per cent of the total unsaponifiable matter.

The non-crystallizable portion of the unsaponifiable matter was not investigated.

Unsaturated Acids

The iodine number of the unsaturated acids was 133.2, indicating that they consisted of a mixture of oleic acid (iodine number 90.1) and linolic acid (iodine number 181.4). Using these data the following percentages were calculated:

	%	In original oil %	Glycerides in original oil %
Oleic acid	52.77	39.21	40.97
Linolic acid	47.23	35.09	36.67
	100.00	74.30	77.64

Saturated Acids

A quantity of the saturated acids (iodine number 2.8) prepared by the lead salt ether method was esterified with methyl alcohol.[10] This mixture of methyl esters was fractionally distilled under diminished pressure. The data for this distillation are given in Table II. A preliminary distillation of the esters was made from a liter Claisson flask. Seven fractions (A, B, C, D, E, F, G) and a residue were obtained. These fractions and residue were redistilled from a 250 cc. Ladinburg flask according to the manner indicated in the table. Seven fractions and a residue were obtained.

Table II—Fractional Distillation of Methyl Esters of Saturated Acids.
(134.85 g. subjected to distillation)
Distillation at 2.5 mm. pressure.

	Fraction	Temperature C.°	Weight G.
	A	148	23.00
	B	149	22.66
	C	150	21.10
	D	151-5	23.00
	E	156-162	22.70
	F	163-180	10.90
	G	181-205	7.30
	Residue		4.20
Fractions A and B redistilled	1	146-148	4.80
Fraction C added	2	148-149	46.42
Fractions D and E added	3	150	43.98
Fractions F and G added	4	152-157	14.10
Residue added	5	158-165	13.80
	6	175-185	6.75
	7	195-215	4.80
	Residue		0.20

The iodine numbers which are measures of the esters of the unsaturated acids present, and the saponification values of fractions 1 to 7 are given in columns 2 and 3 of Table III. Using these data, the mean molecular weights of the saturated acid esters in each fraction were calculated[11] (recorded in column 6).

The results in column 6 indicate what saturated acids may be present in the fractions. The mean molecular weight of the saturated acid esters in fractions 1 and 2 is somewhat less than that of methyl palmitate (270.3) and indicates that these fractions contain some methyl myristate. The results for fractions 3-5 lie between the molecular weights of methyl palmitate and methyl stearate (298.4), which indicates that the fractions contain these esters in various proportions. The molecular weight of the saturated acid esters of fraction 6 indicates a mixture of stearic and arachidic esters (326.4), while that of fraction 7 indicates a mixture of methyl arachidate and lignocerate (382.5).

The free mixed acids were recovered from these fractions by saponifying with alcoholic potash and acidifying the soap solution with hydrochloric acid. The constituent acids were isolated by fractional crystallization from alcohol of the mixture which had been completely freed from mineral acid and salt. The identity of the acids was established by the melting points and by the fact that these melting points were not lowered when the substances were mixed with equal quantities of the respective acids which they were suspected of being, the purity of which had been established previously by elementary analysis.

In all cases the melting points of the isolated acids confirmed the deductions drawn from the mean molecular weights of the fractions.

TABLE III RICE OIL

Fractional Distillation of Methyl Esters of Saturated Acids

Fractions	Iodine number	Saponification value	Mean molecular weight	Esters of unsaturated acide %	Mean molecular weight of esters of saturated acids	Myristic-acid		Palmitic acid		Stearic acid		Arachidic acid		Lignoceric acid	
						%	G	%	G	%	G	%	G	%	G
1	0.6	211.4	265.4	0.53	265.2	17.15	0.823	76.97	3.695						
2	0.6	208.3	269.4	0.53	269.3	3.34	1.550	90.95	42,219						
3	1.54	206.2	272.0	1.36	271.8			88.55	38.945	5.02	2.208				
4	4.7	203.1	276.3	4.16	275.4			77.53	10.509	16.58	2.338				
5	8.6	194.3	288.7	7.62	288.1			32.33	4.461	56.10	7.742				
6	6.7	178.3	314.7	5.94	315.8					34.85	2.352	54.93	3.708		
7	5.9	153.3	366.0	5.32	371.5							17.42	0.736	73.56	3.531
							2.373		99.829		14.640		4.444		3.531

Lignoceric acid ($C_{24}H_{48}O_2$) which melted at 80 to 80.5° C. was isolated from fraction 7. Arachidic acid ($C_{20}H_{40}O_2$) which melted at 77° C. was separated from fractions 6 and 7. Stearic acid ($C_{18}H_{36}O_2$)

which melted at 69° C. was isolated from fraction 6. Palmitic acid ($C_{16}H_{32}O_2$), melting at 63° was obtained from fractions 1 and 2. Myristic acid ($C_{14}H_{28}O_2$), melting at 53 to 54°, was separated from fraction 1.

This establishes the identity of the saturated acids in the fractions of the esters. The quantities were calculated from the mean molecular weights given in Column 6, Table III, and the theoretical molecular weights of the two esters in each fraction. These results are given in column 7-16. The small residue given in Table II was found to contain only decomposition products.

In Table IV the percentage composition of the saturated acids is given in column 3, the percentages of saturated acids in the original oil in column 4, and the equivalent percentages of glycerides in column 5.

Table IV RICE OIL

Acids	Saturated Acids: Weight G	Saturated Acids %	Acids in Original Oil %	Glycerides in Original Oil %
Myristic	2.373	1.9	0.28	0.30
Palmitic	99.829	79.9	11.74	12.32
Stearic	14.640	11.8	1.73	1.81
Arachidic	4.444	3.6	0.52	0.54
Lignoceric	3.531	2.8	0.42	0.43

The mean molecular weight of the total insoluble fatty acids as calculated from the data presented is 277.8, which is 11.5 lower than the value actually found by Browne in the oil of the rice bran used in his feeding experiments upon steers. The latter oil unquestionably contained a much larger percentage of arachidic and lignoceric acids, as is confirmed by the high mean molecular weight, 320.2, of the undigested insoluble fatty acids found by Browne in the oil from the feces of the steers. The supposition advanced by Browne in 1903 as to the existence in rice oil of such higher homologues as arachidic and lignoceric acids has been confirmed by the present work, although the actual percentage of these constituents in rice oils of different origin is no doubt subject to a wide varaition.

Summary

A sample of extracted rice oil with an acid value of 73.7 contained 14.7 per cent of saturated and 74.3 per cent of unsaturated acids. The oil had an iodine number of 99.9 and a saponification value of 185.3. The composition of the oil has been determined with the following results:

	Acid	%
Glycerides of	Oleic	41.0
	Linolic	36.7
	Myristic	0.3
	Palmitic	12.3
	Stearic	1.8
	Arachidic	0.5
	Lignoceric	0.4
Unsaponifiable Matter		4.6

Sterols, which amounted to about 25 per cent of the unsaponifiable matter, were isolated. The several fraction of sterols ranged in their melting points from 137° to 143° C. Also a small quantity of what appears to be melissyl alcohol was obtained from the unsaponifiable matter.

OIL FAT AND WAX LABORATORY,
Bureau of Chemistry, U. S. Department of Agriculture.

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[1] Smethan, Analyst, **18**, 191 (1893).
[2] Shimanzo, Arch. Exp. Path. u Pharm., **65**, 361 (1911).
[3] Garelli, Annali Chim. Applic., **8**, 109 (1917).
[4] J. Am. Chem. Soc., **25**, 948 (1903).
[5] Chem. Revue, **18**, 111 (1911).
[7] J. Amer. Chem. Soc., **42**, 2398 (1920); Cotton Oil Press, **6**, No. 1, 41 (1922).
[8] Annali, chim. applic., **8**, 109 (1917).
[9] J. A.O.A.C., **8**, 439 (1925).
[10] J. Am. Chem. Soc., **42**, 1700 (1920).
[11] J. Chem. Soc. **42**, 156, 1197.

THE CHEOREUL PRIZES

These are named in honor of the great French Chemist who discovered that Fats consist of combinations of Fatty Acid and Glycerine.

They are offered for the three best original articles published in the JOURNAL during the season 1926-1927.

To be considered, the articles must have practical bearing on the Fat and Oil Industry, and be of use to the same.

The competition is open to non-members as well as members of the American Oil Chemists Society.

The judges will be selected by the Prize Committee, from members of the American Chemical Society and the American Institute of Chemical Engineers. Their names will be announced later.

The first prize will be.....	$150
The second prize.....	100
The third prize.....	50

PRIZE COMMITTEE,
David Wesson, *Chairman*

ANNOUNCEMENT OF CO-OPERATIVE F.F.A. TESTS

The Governing Committee of the American Oil Chemists Society has authorized the Refining Committee to conduct co-operative work on F. F. A. tests during the coming season, along lines similar to those of the Smalley Foundation work.

While the F. F. A. test seems a simple one to make, it is nevertheless a fact that serious differences occur very commonly. Discrepancies on such tests between different chemists on duplicate samples of crude oil submitted for refining tests have led to different amounts of caustic being used in refining, thus accounting for some of the variable results in refining tests.

The truly remarkable results secured in the Smalley Foundation work on meal suggests that a similar plan should lead to more accurate and concordant F. F. A. tests and thus, to this extent, assist in getting better checks on refining tests. It was felt that this work should preferably be handled by the Refining Test Committee rather than by the Smalley Foundation Committee and, therefore, the Governing Committee has now authorized the Refining Committee to conduct such co-operative work on F. F. A. under the following plan:

1. The Refining Committee to be in full charge, to make all regulations, to calculate all averages and decide all disputed points.
2. One sample to be sent out each month from September to June inclusive, from the Procter & Gamble laboratory at Ivorydale. A total of 10 samples.
3. A charge of $4.00 to be paid by each participant, directly to the treasurer of the Society. At the end of the year the Procter & Gamble laboratory will render a bill to the Society, covering the actual cost of materials, together with an estimated cost of other expenses involved, all of which is to be paid by the Society to the Procter & Gamble Company. Any surplus or deficit to be borne by the Society's treasury.
4. The object of this work will be solely to improve accuracy. No prizes or certificates to be awarded. Best averages to be calculated substantially as in Smalley Foundation work and results obtained by all participants to be tabulated and sent to each participant as promptly as possible, each month.

The cost is small, and all commercial laboratories, refinery laboratories and other chemists interested in F. F. A. work, are urged to participate for their own good, and the good of the industry. No personal solicitation will be made, but all who are interested should send their $4.00 immediately to the Society's treasurer, in order that we may know how many to provide for.

REFINING COMMITTEE,
C. B. Cluff, Chairman.

THE COTTONSEED OIL FUTURES ACT

Senator Mayfield has introduced a bill (S.4498) called "The Cottonseed Oil Futures Act" which is of very direct interest and concern to this industry. The purpose of the act is stated to be to prevent manipulation and unreasonable fluctuation in the price of cottonseed oil and to provide for establishing official grades and qualities of oil and for buying and selling through contract exchanges which operate under supervision and regulation of the Secretary of Agriculture.

Sections 4 and 5 of this bill are printed here, as they contain the gist of the measure. Those desiring to be more fully informed of the proposed legislation should obtain a printed copy from their Congressman. S.4498 was read twice and referred to the Committee on Agriculture and Industry.

SEC. 4. It shall be unlawful for any person to deliver for transmission through the mails, or in interstate commerce, by telegraph, telephone, wireless, or other means of communication, any offer to make or execute, or any confirmation of the execution of, or any quotation or report of the price of, any contract of sale of cottonseed oil for future delivery on or subject to the rules of any exchange in the United States, or for any person to make or execute such contract of sale, which is or may be used for (a) hedging any transaction in interstate commerce, or (b) determining the price basis of any such transaction in interstate commerce, or (c) delivering cottonseed oil sold, shipped, or received in interstate commerce for the fulfillment thereof, except—

(a) Where the seller is at the time of the making of such contract the owner of the actual physical property covered thereby; or

(b) Where such contract is made by or through a member of an exchange which has been designated by the Secretary of Agriculture as a "contract exchange," as hereinafter provided and if such contract is evidenced by a record in writing which shows the date, the parties to such contract, and their addresses, the property covered and its price, and the terms of delivery: *Provided,* (1) That each exchange member shall keep such record for a period of three years from the date thereof, or for a longer period if the Secretary of Agriculture shall so direct, which record shall at all times be open to the inspection of any representative of the United States Department of Agriculture or the United States Department of Justice; (2) that the Secretary of Agriculture may fix and prescribe grades, classes and other qualities of cottonseed oil, to be known as the official standards of the United States for cottonseed oil, one of which said official standards, when established, shall be made the basis grade of all such contracts, and the Secretary of Agriculture may prescribe the means and methods and agencies by which cottonseed oil may be classified or graded for delivery on or in settlement of any such contract, and the form of certificate or memorandum by which such classification shall be evidenced, and no cottonseed oil shall be delivered on or in settlement of any such contract unless it be of or within said official standards; and (3) that in case any cottonseed oil of grade, class, or quality other than the basis grade, class, or quality specified in such contract be tendered or delivered in settlement thereof, the difference above or below the contract price which the receiver shall pay for such grades, classes, or qualities other than the basis grade, class, or quality shall be the actual commercial differences determined under the direction of the Secretary of Agriculture and in accordance with regulations to be prescribed by him.

SEC. 5. The Secretary of Agriculture is hereby authorized and directed to designate any exchange as a "contract exchange" when, and only when, such exchange complies with and carries out the following conditions and requirements:

(a) When the governing board thereof provides for the making and filing by the exchange or any member thereof, as the Secretary of Agriculture may direct, of reports in accordance with the regulations, and in such manner and form and at such times as may be prescribed by the Secretary of Agriculture, showing the details and terms of all transactions entered into by the exchange or the members thereof, either

in cash or spot transactions consummated at, on, or in an exchange, or transactions for future delivery, and when such governing board provides, in accordance with such regulations, for the keeping of a record by the exchange or the members thereof, as the Secretary of Agriculture may direct, showing the details and terms of all cash or spot and future transactions entered into by them, consummated at, on, or in an exchange, such record to be in permanent form, showing the parties to all such transactions, including the persons for whom made, any assignments or transfers thereof, with the parties thereto, and the manner in which such transactions are fulfilled, discharged, or terminated. Such record shall be required to be kept for a period of three years from the date thereof, or for a longer period if the Secretary of Agriculture shall so direct, and shall at all times be open to the inspection of any representative of the United States Department of Agriculture or the United States Department of Justice.

(b) When the governing board thereof provides for the prevention of dissemination by the exchange, or any member thereof, of false or misleading or knowingly inaccurate reports concerning crop or market information or conditions that affect or tend to affect the price of cottonseed oil in interstate commerce.

(c) When the governing board thereof provides for the prevention of manipulation of prices or the cornering of any cottonseed oil by the dealers or operators upon such exchange.

(d) When the governing board thereof does not exclude from membership in, and all privileges on, such exchange any duly authorized representative of any lawfully formed and conducted cooperative association having adequate financial responsibility, which is engaged in the production or handling of cottonseed, cottonseed oil, or the products and by-products thereof, if such association has complied, and agrees to comply, with such terms and conditions as are or may be imposed lawfully on other members of such exchange, and when membership in the exchange is open to all persons who agree to and do comply with such terms and conditions as may be lawfully imposed on members: *Provided,* that no rule of a contract exchange shall forbid, or be construed to forbid, the return on a patronage basis by such co-operative association to its bona fide members of moneys collected in excess of the expenses of conducting the business of such association.

(e) When the governing board provides for making effective the final orders or decisions entered pursuant to the provisions of paragraphs (b) of section 7 of this Act.

ESSENTIAL OILS THE CAUSE OF FIRE

One of the most spectacular fires in recent years in New York City occurred in July when the premises of Pierre Lemoine, Inc., dealers in essential oils, was gutted. Four alarms brought twenty-three engines, five trucks, a water tower, the rescue squad, ambulances from two hospitals, and reserves from two police stations. The origin of the conflagration was believed to be the result of highly explosive fumes from the oil, which when ignited rocked the whole neighborhood and brought business to a standstill in that part of the downtown section.

HIGH REFINING LOSS AFFECTS PRICES FOR COTTONSEED OIL*

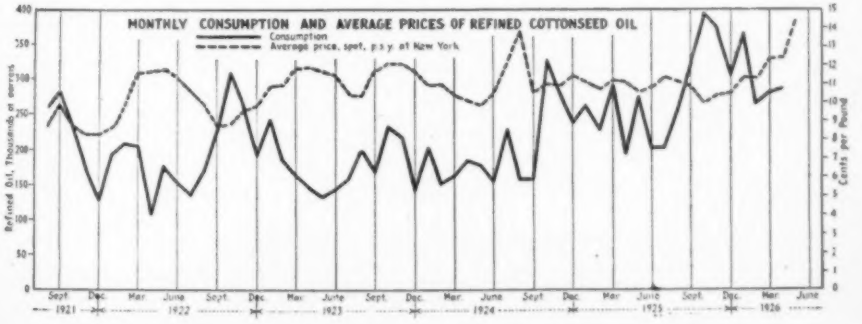
At the beginning of the 1925-26 cottonseed oil year, opinion in trade circles was almost unanimous in favoring a low-priced period for crude and refined oils. To start with there was a carryover equivalent to 474,000 bbl. of refined oil. In the second place, a large increase over the preceding season had been recorded in the cotton crop. With a larger seed supply, it was logical to look for a more or less corresponding increase in production of oil which with the carryover would offer a total supply for the year far in excess of what had come to be regarded as normal requirements.

These expectations seemed destined to be realized when early ginning reports revealed that cotton was being marketed in large volume. Under the influence of large offerings of seed, the market for crude cottonseed oil eased off in price and refined oil not only followed suit but took the lead in the downward movement. From October on, however, the trend of values was almost continuously upward and the rise in values became more pronounced as the season advanced.

This remarkable upset to price calculations is attributed to two important factors. Production of refined oil did not show an increase over the preceding season commensurate with the increase in seed supplies. Loss in refining crude oil ran exceptionally high and cut deeply into the output of the refined product. In the preceding season refining loss was reported at about 9 per cent while for the present season 17 per cent is given as a fair average with some reports running as high as 25 per cent loss. The second factor which had an important part in establishing high prices was found in the record consumption of oil among domestic industries.

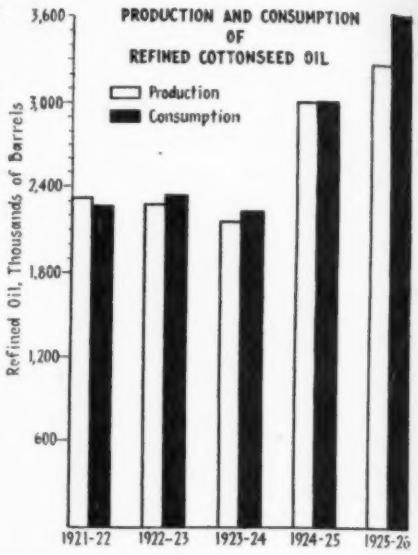
In the latter part of the 1924-25 season, the disappearance of cottonseed oil was on a large scale. This was explained by the strong position of the market for hogs and lard and the consequent stimulus given trading in lard compound which offers the largest outlet for cottonseed oil. To

*Reprinted from Chemical and Metallurgical Engineering.


MONTHLY CONSUMPTION AND AVERAGE PRICES OF REFINED COTTONSEED OIL
Consumption
Average price, spot, p.s.y. at New York
Refined Oil, Thousands of barrels
Cents per Pound
Sept. Dec. Mar. June Sept. Dec. Mar. June Sept. Dec. Mar. June Sept. Dec. Mar. June Sept. Dec. Mar. June
1921 1922 1923 1924 1925 1926

Production and Consumption of Refined Cottonseed Oil

Crop Year	Production, Bbl.	Consumption Bbl.
1925-26.....	3,298,000	3,650,000
1924-25.....	3,190,000	3,019,000
1923-24.....	2,162,000	2,236,000
1922-23.....	2,271,000	2,340,000
1921-22.....	2,320,000	2,260,000



a certain extent the lard market may be credited with helping demand for cottonseed oil in the present season but within the past few days the price for oil has crossed that for lard and current oil values are dominated by the law of supply and demand.

Production of refined oil is given in the accompanying tables,

Average Monthly Prices for Spot P.S.Y. Cottonseed Oil at New York

	1925-26	1924-25	1923-24	1922-23	1921-22
August	11.16	13.85	10.31	9.95	8.69
September	10.82	10.52	11.62	8.70	9.88
October	9.91	11.03	12.06	8.88	8.69
November	10.31	10.86	11.65	9.50	8.30
December	10.47	11.41	11.00	9.81	8.28
January	11.34	11.17	11.01	10.83	8.62
February	11.27	10.70	10.36	10.90	9.91
March	12.33	11.15	9.76	11.77	11.53
April	12.40	11.09	10.08	11.81	11.57
May	14.50	10.55	9.82	11.60	11.71
June	....	10.77	10.43	11.42	11.30
July	....	11.36	12.07	10.35	10.69

Monthly Consumption of Refined Cottonseed Oil

	Crop Year 1925-26, Bbl.	Crop Year 1924-25, Bbl.	Crop Year 1923-24, Bbl.	Crop Year 1922-23, Bbl.	Crop Year 1921-22, Bbl.
August	254,000	157,000	203,000	169,000	259,000
September	321,000	157,000	169,000	229,000	283,500
October	395,000	328,000	232,000	309,000	233,500
November	375,000	281,000	219,000	263,000	173,500
December	309,000	238,000	145,000	194,000	129,000
January	369,000	262,000	203,000	242,000	192,000
February	266,000	228,000	153,000	187,000	208,500
March	282,000	293,000	162,000	164,000	204,000
April	288,000	193,000	188,000	148,000	109,500
May*	.....	278,000	179,000	133,000	179,500
June*	.....	302,000	153,000	143,000	152,000
July*	.....	302,000	230,000	159,000	136,000
	2,859,000	3,019,000	2,236,000	2,340,000	2,260,000

*Figures not yet available, but estimates place 800,000 bbl. as probable consumption for the three months, which would give a total of 3,659,000 bbl. as consumption for 1925-26.

the totals representing consumption as reported monthly by the government with due allowance for the difference in carryover at the beginning and end of the respective seasons. Figures also are given to show monthly.

In order to overcome a possible shortage in oil supplies, attempts have been made to import cottonseed oil. There is a difference of opinion regarding the amount of foreign oil which has been bought for shipment to this country, but well informed members of the trade say this movement was not started early enough to offer much relief and that about 75,000 bbl. is all that can be expected before new crop domestic oil comes on the market. Scarcity of tonnage is said to be the chief obstacle to foreign trade as prices abroad are below the domestic parity.

Charles C. Phelps, secretary and sales manager of the Uehling Instrument Company, Paterson, N. J., has just completed a ten weeks' trip visiting all of the company's southern representatives, as well as several in the Middle West. Most of this time was devoted in actual field work with the idea of better fitting the representatives to co-operate with users of Apex CO_2 Recorders and Fuel Waste Meters. Mr. Phelps made a special study of the application of these instruments in oil refineries.

DESIGN AND OPERATION OF A SOLVENT EXTRACTOR PLANT

By LOUIS C. WHITON

In the previous paper "The Practical vs. the Theoretical Side of Oil Extraction," the conclusion was drawn that the moderate sized extractor of 5000-6000 pounds capacity per charge, without any movable parts such as agitators or circulating pumps, and which was not inter-connected with any other unit, in its main functions, was commercially the most practical type.

This paper will describe the method of operation of each unit of an extractor of this design, and the points of importance in laying out an installation of several units.

A large variety of materials may be advantageously extracted with solvents, such as oil-bearing seeds, copra, palm kernels, press-cakes, bones, etc. The treatment of a whole seed such as cottonseed, flaxseed, castor-bean, soya or a similar product will be discussed.

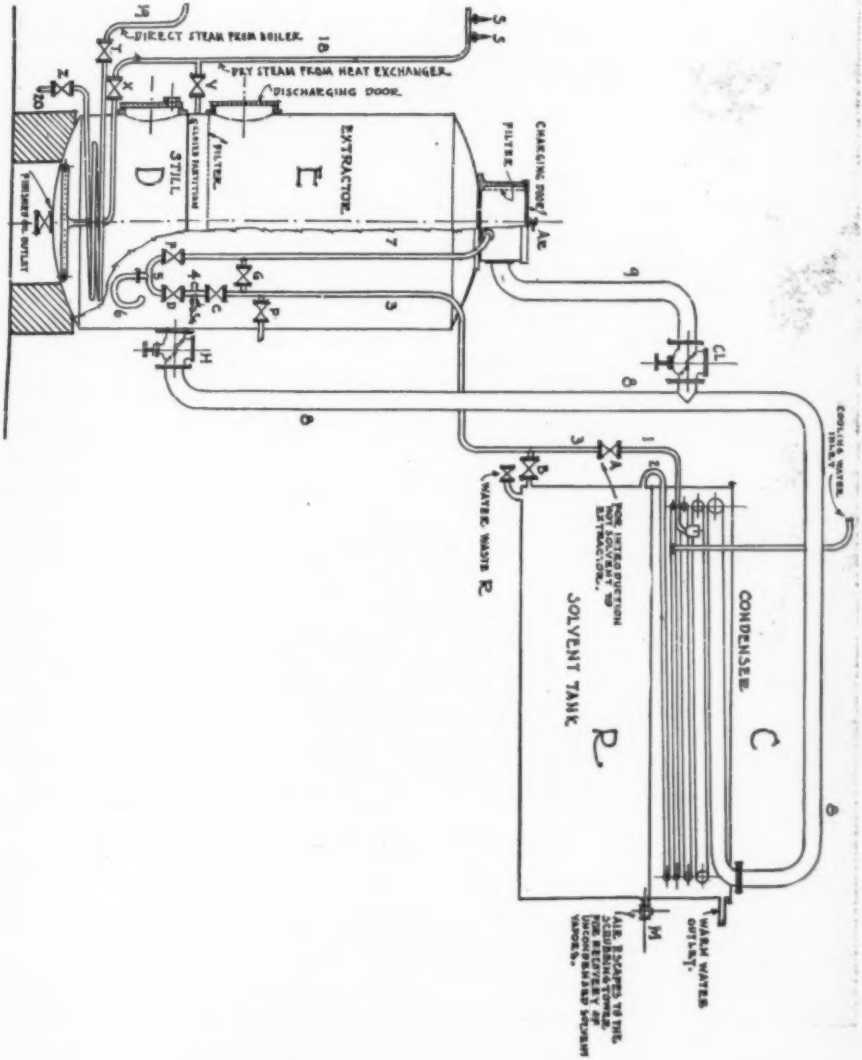
Crushing

The first step—and a vitally important one—is the proper disintegration of the seed. This operation requires special treatment in connection with extraction. The crushers usually found in hydraulic press plants are not suitable for an extraction plant. The object of the operation is the breaking of the exterior of the seed, with the production of as little finely pulverized material as possible, since fines slow up extraction by clogging the filter cloths in the extractor. The most suitable crusher consists of a single pair of rolls each one operating at a different speed. This tears open the seed without mashing of pulverizing it. The ideal condition for cottonseed, for example, is to produce it in pieces 1/16 inch to 1/8 inch in size; for flaxseed, to break the seed into two or four pieces. The rolls should be capable of accurate regulation of spacing and the feed should be uniform. It is better to have an occasional whole seed pass, then to pulverize the product. The regulation of the operation of the rolls is accomplished by first permitting an evident quantity of whole seed to pass, and then gradually bringing the rolls nearer together until the point has been reached where whole seeds have ceased to appear in the crushed product.

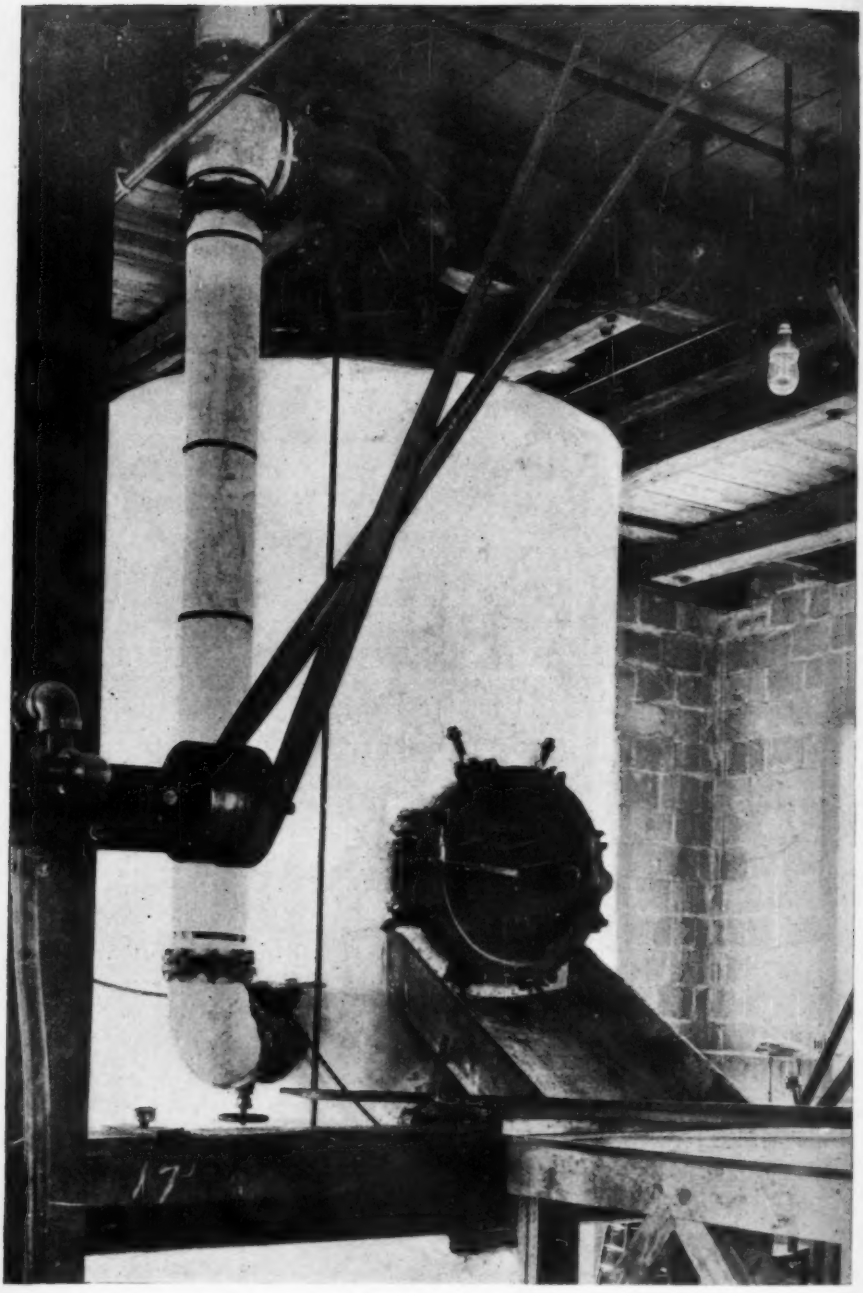
Handling of Crushed Seed

The crushed seed should be handled as little as possible in order not to break it down further than was accomplished by the rolls. An ideal arrangement is the placing of the rolls on an upper floor so that the seed will discharge by gravity into a hopper for feeding the extractors. This is not always feasible in a layout, however, and as will be seen in Fig. 3,

it is generally necessary to elevate the crushed material. Bucket-conveyors are satisfactory. For the transverse handling over the extractor a steel band conveyor is most suitable. Cloth belt conveyors become oil soaked and rancid; rubber is deteriorated by the oil. A screw conveyor, or a scrape conveyor are both to be avoided because of the increase in fine material that is caused by them.



Single Unit Extraction Plant



Flaxseed Extractor Showing Discharging Door from Which Extracted Material is Removed

Storing of Crushed Seed

After the material has been crushed, it should be stored for as short a time as possible because oxidation not only deteriorates the exposed oil, but the fermentation creates a tendency to foaming in the still used for distilling the solvent from the extracted oil. Consequently crushing should be done only as rapidly as the extrators can handle the material.

Charging the Extractor

The capacity of an extractor is dependent upon the number of charges per unit time; consequently any one of the several operations that can be speeded up is to the advantage of the owner. By having an entire charge ready and in a hopper above the extractor, as shown in Fig. 3, the material can be charged in rapid time through the chute. This has evident time saving advantages over charging from a conveyor. Another method is the use of a lorry hopper, running on tracks above each group of extractors. This avoids the necessity of the transverse conveyor and the handling of the material is at a minimum. The material rests upon the filter at the bottom of the extractor, which is filled to the neck of the charging casting.

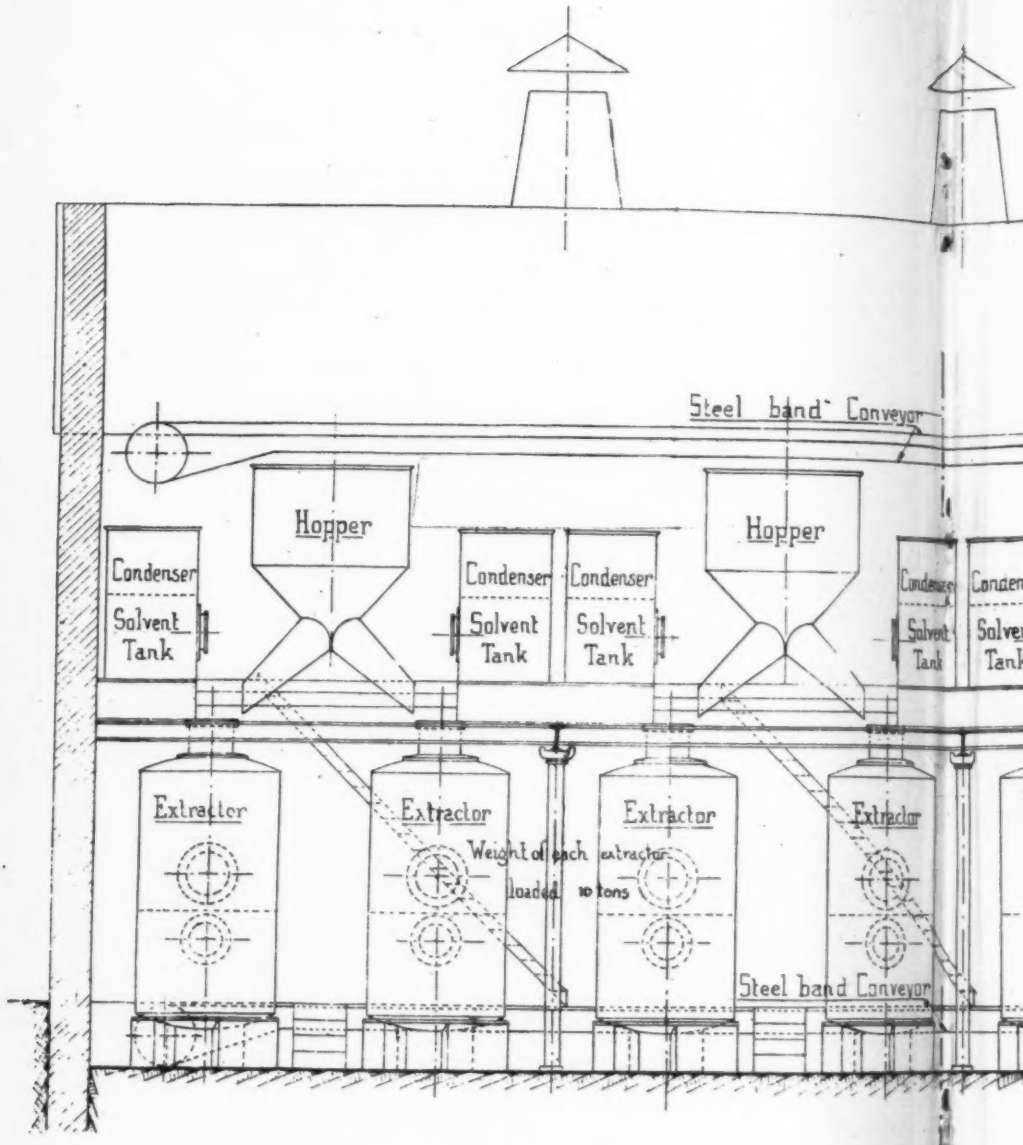
Introduction of the Solvent

When introducing the solvent, it is important to avoid the formation of channels, air-pockets, uneven welling of the material, and the tendency for it to pack against the filters. The apparatus shown in outline in Fig. 1, is so arranged as to avoid the above by having the solvent introduced at the bottom of the extractor, instead of at the top as is usually the case. The solvent rises through the material, thus decreasing the pressure of the seed against the bottom filter and forcing the air in the extractor to the condenser and solvent tank. Since this air has been in contact with solvent, it contains solvent vapor which would be lost when evacuating to the atmosphere.

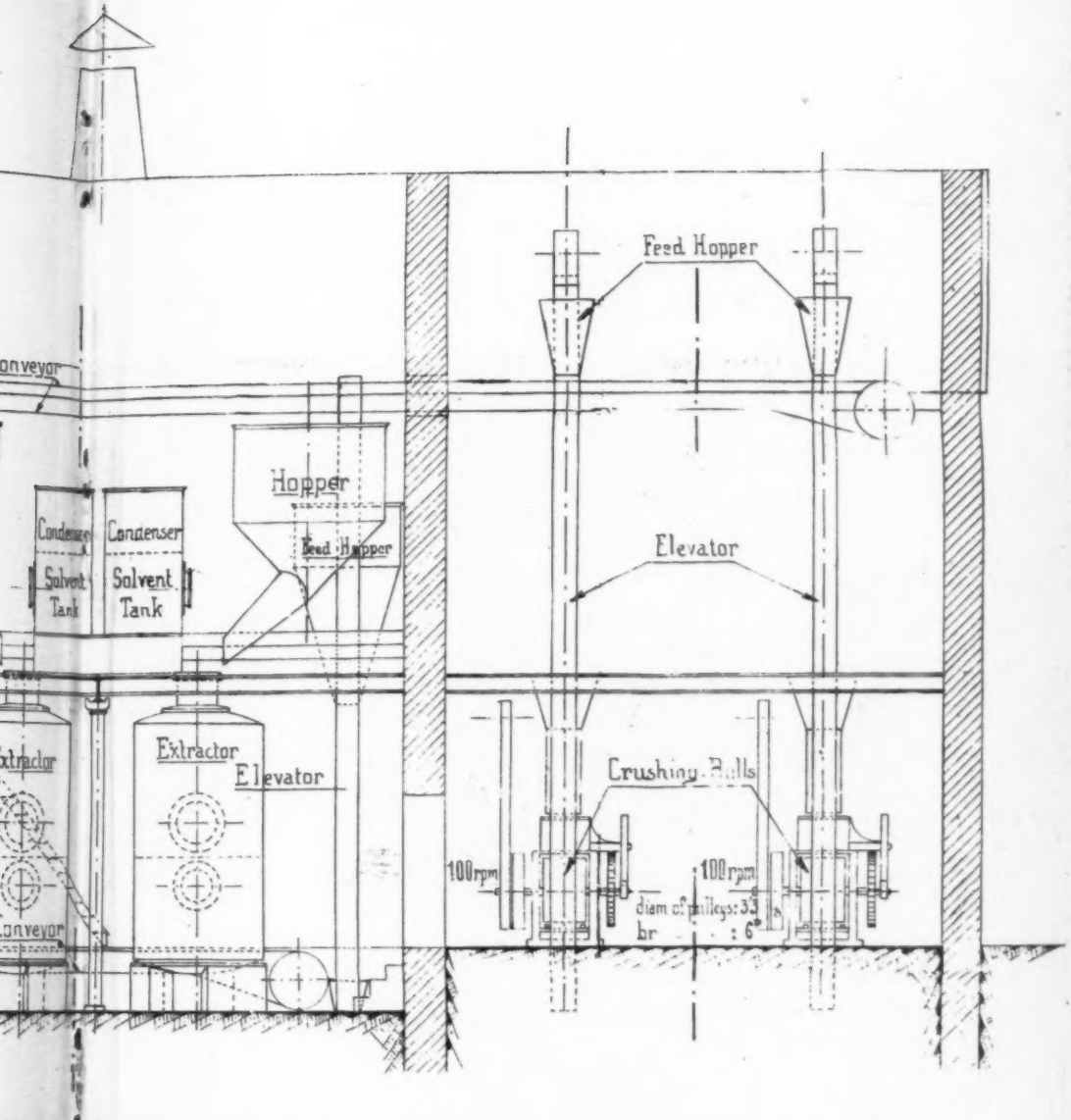
The Bataille installations recover this solvent by use of an oil scrubbing tower for each battery of extractors. This is connected to the individual tanks via the connection shown at the right of this tank, in Fig. 1. The oil generally employed for scrubbing is that produced in the plant. Intermittently it is run to one of the stills and the oil and the absorbed solvent returned to the system. This scrubbing tower also acts as the means of condensing vapors that may pass the condenser at any time during the subsequent operations, as it will be appreciated that a perfect condenser is commercially impossible without a refrigeration system.

Extraction and Distillation

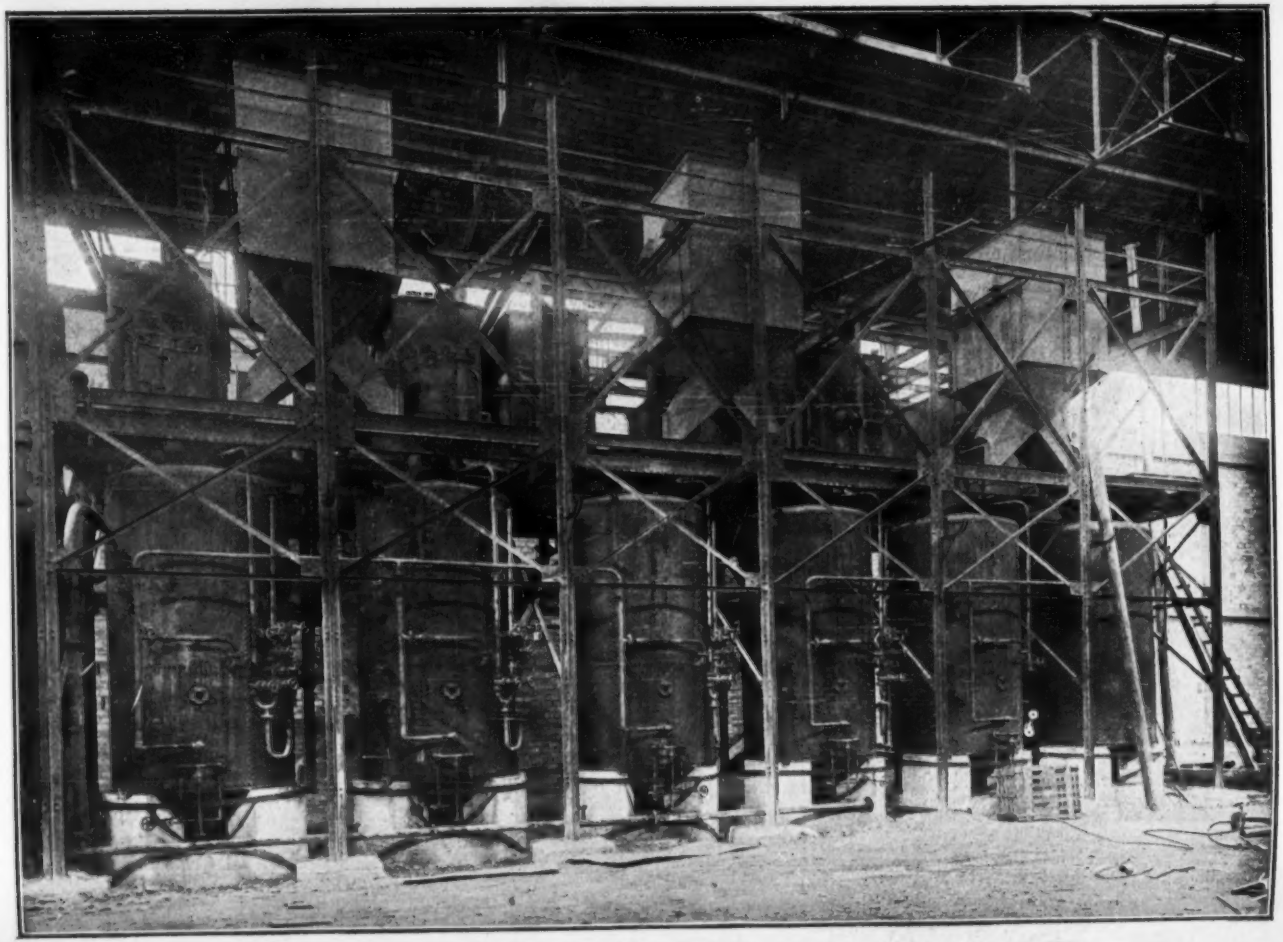
The extractor shown in Fig. 1 is capable of having the solvent flow proceed from the bottom upward, overflowing the solvent containing dis-



General Layout of Five-Extractor Extraction Plant U



Extraction Plant Using Independent Operating Extractors



Modern Bataille Extractions Plant

solved oil through the drum shaped filter fitting around the interior of the charging casting and thence to the still by pipe 7; or the solvent current may be reversed. In both instances the extractor should be kept completely full of solvent. The upward flow is used in case a solvent such as trichlorethylene with a higher specific gravity than oil is used; the downward flow is indicated where a solvent is used, such as benzol or a special cut of gasoline which is lighter than the oil.

The oil bearing solvent overflows by gravity to the still and indirect steam vaporizes the solvent which passes by vapor pipe 8 to the condenser. At this point it is short-circuited and withdrawn through pipe 1. The solvent vapor at this point in the condenser, has been liquified but practically is at its boiling point and extraction is accelerated considerably thereby.

At the end of several hours extraction, about 1 per cent oil remains in the material. Although this can be reduced if desired it is not generally commercially worth while. However, the writer has visited a Bataille Extraction plant which produces an oil-free special diet for diabetics from wheat germs. Incidently this installation producing food for human consumption is interesting evidence of the fact that solvent free meal for cattle feed presents no difficulties of production, provided the proper solvent and design of extractor is employed.

Deodorization of Extracted Residue

In the early days of solvent extraction it was recognized that in order to properly deodorize the extracted residue of any trace of solvent, it was necessary to agitate the material during the period of steaming. The mechanical difficulties of agitating a mass of meal which is not floating in liquid are many, aside from the evident disadvantages of offering a chance of escape of solvent vapors at the stuffing box, as well as the power consumed. The early Bataille extractors adopted the agitator until the simple expedient of completing the extraction period with solvent vapors, instead of liquid, was invented. Referring to Fig. 1, it will be seen that when check valve C1 is lifted, the vapors from the still will be drawn directly into the extractor as the final drain is taking place. The temperature on the interior of the insulated extractor is a few degrees below the boiling point of the hot solvent used for extraction and the vapors replace the liquid so that when dry steam is blown through the material, the elimination of residual gaseous solvent is largely accomplished by displacement. The main reason for the existence of an agitator, therefore, no longer exists.

Deodorization of the Oil

To anyone familiar with oil refinery deodorizing practice, it will be readily appreciated that the steam distillation of an oil is capable of remov-

ing even remote traces of volatile esters and aldehydes, which cause the taste (or in reality odor) of the oil. The same principle is used in completing the extracted oil and it is probable that a slight deodorization of the oil takes place, even beyond the point of the removal of the low boiling solvent (which in all cases should have no products whatever boiling over 200° F.)

Discharging the Extractor

Mechanical discharge—either by rotating a horizontal extractor, or turning an agitator—takes about the same length of time as hand discharge. The comparitively dry material (containing about 14 per cent moisture) creates a considerable resistance to the agitator. The labor factor is not an item since the helper around the plant consumes from ten to fifteen minutes for extraction per extractor per shift to discharge by hand.

Drying

The discharged material has been subjected to direct steam during deodorization of the meal and its moisture content generally runs about 14 per cent, although its appearance is dusty dry. If the screw conveyor handling the discharged material is maintained hot by means of a steam jacket, this is sufficient to permit the evaporation of excess moisture over that usually required for the finished meal.

The general method of operation and the layout of a solvent extractor plant have been described above. In a subsequent paper the cost of operation and the effect and application of various solvents will be discussed in connection with different materials which may be advantageously extracted by solvents.

I. F. Laucks, Inc., analytical and consulting chemists, have removed their offices to 314 Maritime Building, Seattle.

INTERCHANGEABILITY OF OILS AND FATS IN THE SOAP INDUSTRY

Note: But little quantitative information has ever been available on the industrial consumption of oils and fats and particularly on the competitive relation that exists among the different products in their ultimate uses. The soap industry, because of its size and varied production, offers the broadest possibilities for this interchange of raw materials. It is of interest, therefore, to study the consumption statistics in this industry over a considerable period in order to evaluate the factors that determine suitability. Such a study has recently been completed by the United States Tariff Commission in its investigation of vegetable oils under the provisions of the flexible tariff. The following article, abstracted from the commission's preliminary statement of information by Chemical and Metallurgical Engineering, is typical of the economic study that has been made in each of the principal oil-consuming industries.

Any oil or fat may be converted into soap, but the kind of soap produced will vary greatly because of the widely different physical and chemical characteristics of the various oils and fats used. Each kind or grade of soap is made from an oil or combination of oils that will yield a product of the desired properties. When there are considered the many types of toilet soaps and the large variety of soaps that are used in everyday life, as, for example, soap chips, soap powders, laundry, scouring, shaving, shampoo, medicated, liquid, mechanic's textile, and automobile soaps, it will be seen what a wide difference exists in the soaps obtained by the use of various oils and fats and other ingredients and by different methods of manufacture.

Interchangeability in the soap industry does not mean complete substitution of one oil for another. Although this may occur, interchangeability usually involves changes in the relative proportions of the contituent oils and fats, and also substitution of other materials for a portion of one or more of the constituents, as dictated by prevailing prices.

One of the most important factors in buying oils and fats for soap making is the titer of the material, which indicates the hardness of the soap that can be made from it. Manufacturers endeavor to have each brand of soap of a uniform consistency. In making hard soaps, materials of low titer, such as soya-bean, cottonseed, olive, corn, or whale oils, cannot be used exclusively. If they are used they must be mixed with a material of high titer, such as tallow, palm oil, or coconut oil.

The fatty-acid content is important from the soap makers' point of view, inasmuch as the higher the fatty acid, the smaller is the recovery of glycerine—a valuable byproduct. In general, materials of high fatty-acid content do not make satisfactory stock for soaps (including most toilet soaps) which are made by direct treatment of oils and fats in the soap kettle with caustic soda. The free fatty-acid content is of less importance, except for the recovery of glycerine, in oils and fats used for laundry and industrial soaps, which are largely made from fatty acids after being separated from the oil or fat.

The color of an oil or fat is not usually so important in making soaps as it is in the manufacture of edible products. However, white soaps, soap chips, and soap powders must be made from materials which will yield a product of good permanent color. The oils and fats most suitable for white soap are coconut oil, tallow, and white greases. These are not fully interchangeable with each other because of the different properties which they impart to the finished soap. Some soaps are made from oils which give a characteristic color to the product, such as the green of olive-oil foots, and the orange shade of palm oil. Such oils cannot be used in white soaps in amounts which will affect the color.

Yellow laundry soaps are made from lower grade materials the color of which often cannot be removed. Such materials include low-grade tallows, garbage and tankage grease, yellow and brown greases, vegetable-oil foots, fish oils, and offgrade cottonseed oil. Rosin is commonly used in laundry soaps and imparts a yellow color to the soap. White laundry soaps have replaced the yellow to a considerable extent; they are made from better grades of oils and fats, such as coconut oil, tallow, and white greases. The soap used in scouring powders is usually made from vegetable-oil foots, tallows, and greases.

Soaps possessing special characteristics are made from certain individual oils. Pure castile soap should be made from olive oil only. Much of the soap sold in the United States as castile soap, however, is made from oils or fats other than olive oil. Shaving, marine, and hard-water soaps usually contain a large proportion of coconut oil because of the excellent lathering qualities of soap made from it. Certain transparent soaps are made from castor oil. Linseed oil is the basis of some liquid soaps.

Classified by Technical Characteristics

Some of the principal oils and fats used in the manufacture of soap may be divided into three rather broad classes. The grouping shows the titer and the iodine number of each oil or fat. The titer indicates the hardness of the soap resulting from the oil and the iodine number of amount of hydrogen that the oil will combine with when hardened.

Table I.—Titer and Iodine Number of Typical Soap Oils

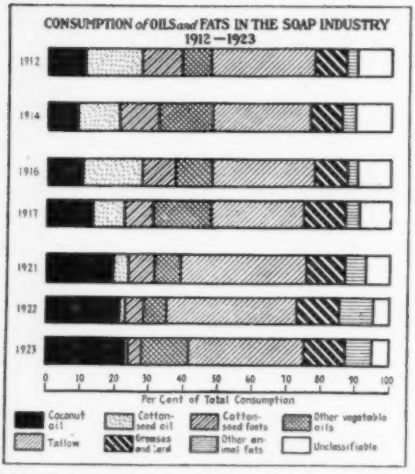
	Titer	Iodine Number
Group I:		
Tallow	38—48	35—41
Palm oil	36—45	53.3
Group II:		
Coconut oil	22.5—25	8. 4— 9.3
Palm kernel oil	20.5—25.5	12
Group III:		
Cottonseed oil and foots	32—35	111—115
Soya-bean	21.2	138—142
Peanut oil	29.2	95—104
Corn oil	19	119.5
Olive oil foots	17—26	86—90

Table II.—Oils and Fats Used by the U. S. Soap Industry (in thousand pounds)

Table II.—Oils and Fats Used by the U. S. Soap Industry (in thousand pounds)

Consumption of—	1912	1914	1916	1917	1919	1921[1]	1922[1]	1923[1]
Vegetable oils:								
Coconut	78,816	77,959	111,084	168,602	182,613	194,417	237,702	267,982
Corn	9,822	11,368	12,821	15,997	2,405	2,405	4,941	5,617
Cottonseed	132,312	119,254	194,916	126,390	56,130	47,935	19,759	10,824
Olive-oil foots	5,457	7,298	9,411	10,500	3,964	15,842	20,688	27,324
Olive-oil, inedible	690	748	1,184	1,731	935	767	1,047	1,317
Palm	7,546	[2]71,896	14,938	27,345	17,268	24,386	30,389	102,323
Palm kernel	20,579	31,376	5,804	4,762	4,551	593	685	3 287
Peanut	31	76	1,181	15,126	3,055	10,983	6,711	6,905
Soya-bean	1,182	4,499	57,373	124,058	58,401	10,756	2,307	3,266
Cottonseed foots	89,127	108,141	112,178	115,942	108,389	76,018	61,966	52,676
Miscellaneous	20,142	17,831	21,604	25,694	20,328	11,807	9,952	10,477
Total	365,704	450,446	542,594	636,147	457,769	395,909	396,147	491,998
Animal fats and oils:								
Bone grease	17,526	16,632	19,535	37,032	([3])	839	2,107	1,308
Garbage grease	12,619	13,627	28,719	63,118	([3])	19,104	22,010	15,493
Lard	8,469	10,484	8,294	7,481	([3])	([4])	([4])	([4])
Recovered grease	2,858	10,627	8,531	12,680	([3])	([4])	([4])	([4])
Tankage grease	28,566	31,822	35,769	38,303	([3])	247	1,427	173
Tallow	238,685	270,713	338,931	362,297	([3])	373,223	429,966	401,926
White grease	([4])	([4])	([4])	([4])	([3])	31,489	36,902	42,669
Yellow grease	([4])	([4])	([4])	([4])	([3])	32,009	36,872	39,352
Brown grease	([4])	([4])	([4])	([4])	([3])	30,461	42,667	41,170
Red oil	8,723	10,275	10,230	12,812	24,205	13,149	10,431	12,233
Herring and sardine oil	56	10,339	2,705	4,104	([3])			
Menhaden	116	882	330	2,279	([3])	32,592	29,689	31,941
Whale oil	9,927	4,023	8,126	5,732	([3])	5,021	60,816	41,328
Miscellaneous	7,272	13,202	18,860	30,919	406,412	12,241	9,217	11,857
Total	334,817	392,826	480,030	576,757	430,617	550,375	682,104	639,450
Unclassifiable:								
Fatty acids, acidulated and misc. soap stock	74,635	92,917	107,388	124,601	30,653	71,039	53,808	57,328
Grand total	775,156	936,189	1,129,812	1,337,505	919,039	1,017,323	1,132,059	1,188,776

[1] Estimated from data submitted to Tariff Commission. [2] Bulletin 769, U. S. Department of Agriculture, Supplement, p. 6, reported 71,896,000 pounds of palm oil consumed in soap in 1914. This figure is apparently an error, since it exceeds imports of palm oil in either 1913, 1914, or 1915 by about 20,000,000 pounds. [3] Included in miscellaneous animal fats and oils. [4] Included in other specified animal fats and oils.



Chart, Based on Table II, Showing Relative Percentages of the Different Oils Used in the Manufacture of Soap.

In general, it may be said that in the manufacture of soap the substitution of one oil for another is made within the limits of each group. It is, of course, possible to make an oil in Groups II or III comparable with tallow and palm oil in Group I by the process of hydrogenation or hardening. Unless a soap company is also engaged in the manufacture of lard substitutes, which require the hardening of vegetable oils, it is not ordinarily equipped to harden oils for exclusive use in the manufacture of soap. Such companies therefore depend largely upon oils and fats that produce hard soaps, such as tallow and palm oil, since they prefer not to buy hardened oils from competing companies.

Palm oil and tallow are not so closely related that one can completely replace the other, but palm oil may in part replace tallow in soap.

In Group II, coconut and palm-kernel oils are practically equivalent, and a difference in price of one-eighth to one-quarter cent per pound may cause a shift from one to the other oil. The oils and fats in Group III make softer soaps than those in Group I and II. These oils are generally used to reduce the titer or hardness of soap made from tallow and palm oil. In this group cottonseed, peanut, and corn oils, except foots and off grades, are ordinarily too high priced to be used for soap. Corn oil when used in the manufacture of soap oxidizes and thereby tends to darken the finished product; it also develops an unpleasant odor in the soap. Cottonseed oil not only is too expensive for the cheaper grades of soap, but when used in the finer grades of toilet soaps causes them to deteriorate.

Soap makers who specialize in trade-marked brands of soap which are widely advertised are more conservative in shifting from one oil to another. They will not risk the loss in sales which might result from modification of their soap formulas to an extent noticeable by consumers of their products. Olive-oil foots and palm oil produce colored soaps. Obviously such oils cannot be used in white soaps in appreciable amounts.

So numerous are the factors entering into the making of a soap that it is not possible to state definitely the exact degree of interchangeability which exists between the various oils and fats. The extent to which interchangeability or substitution is possible depends not only on the soap

maker but on the kind of soap produced. Therefore, only the above generalizations can be made, and emphasis laid on the more important factors, such as titer, color, odor, fatty acid. brands and trade-marks, and price, which affect interchangeability.

Table II shows the consumption of oils and fats by the domestic soap industry from 1912 to 1923, inclusive, except the years 1913, 1915, 1918, and 1920. The estimated consumption for 1921 to 1924, inclusive, is based on returns to the Tariff Commission from 74 companies producing about 90 per cent of the total soap production. The accompanying chart, based on the figures on Table II, indicates the relative percentages of the different oils and fats used by the soap industry in seven typical years since 1912.

In 1923, 56 per cent of all the oils and fats used by the reporting companies in the soap industry was made up of tallow and cocoanut oil, 34 and 22 per cent, respectively, of all oils and fats. If other animal greases are added the total would represent more than two-thirds of the oils consumed in the manufacture of soap. Among the other oils and fats consumed by the soap industry are palm oil (8.6 per cent of all oils and fats), fish oils, including whale oil (6.2 per cent), and cottonseed foots (4.4 per cent).

Coconut oil is now the most important vegetable oil used in soap manufacture, making up 23 per cent of the total of oleaginous materials. The use of this oil has steadily increased and is now more than twice as great, in relation to all oils, as in 1912 and 1914, and the actual quantity consumed is more than three times as much. The import duty of 2 cents a pound on coconut oil does not apply to shipments from the Philippines, which are about 96 per cent of the total quantity entering the United States. Nor is there a duty on imports of copra, whatever the origin. More than 99 per cent of the coconut oil used by soap manufacturers since 1921, including the oil produced in this country from imported copra, was exempt from import duty.

Palm oil, which is not dutiable, was unimportant in 1912, supplying less than 1 per cent of the total consumption of oils and fats used in soap factories. In no year between 1912 and 1917, inclusive, did the consumption of palm oil exceed 2 per cent of the total. In 1921 and 1922 palm oil supplied about 2.5 per cent of the total consumption, and in 1923 about 9 per cent (102,323,000 pounds). The consumption of inedible olive oil, including olive-oil foots—also nondutiable—has also shown a significant increase, although still a small part of the total. In 1923, the consumption was 28,641,000 pounds, or between four and five times the pre-war figure, but represented only 2.3 per cent of all oils and fats. Palm-kernel oil, which is a substitute for coconut oil, has declined greatly, not only in

actual quantity but in relation to all oils consumed. The consumption in 1923 was only one-tenth of that in 1912 and 1914 and was only three-tenths of 1 per cent of all oils used. Although a desirable oil and exempt from duty, British control of the trade in and crushing of palm kernels, prevents its extensive use in the United States. Palm-kernel oil is one of the most important oils used for soap making in England.

The increase in the use of soya-bean oil by the soap industry from 1,000,000 pounds in 1912 to 124,000,000 pounds in 1917, and the subsequent decline to less than 3,500,000 pounds in 1923, is one of the striking changes that have occurred in the consumption of oils by the soap industry. But in relation to the total consumption of oils and fats in soap, soya-bean oil has never been of major importance. At the peak of consumption, in 1917, under abnormal conditions of demand for all oils and fats, it supplied only 9 per cent of the total. (See Tables II and III.)

Table III.—Relative Consumption of Oils and Fats by the Soap Industry in the United States: 1912, 1914, 1916, 1918 and 1921-23

(Percentage of total oils and fats consumed)

Consumption of—	1912	1914	1916	1917	1921	1922	1923
Vegetable oils:							
Coconut	10.2	8.3	9.9	12.6	19.1	21.0	22.5
Corn	1.3	1.2	1.1	1.0	.2	.4	.5
Cottonseed	17.1	12.3	17.3	9.5	4.7	1.7	.9
Olive-oil foots	.7	.8	.8	.8	1.6	1.8	2.3
Palm	1.0	17.7	1.3	2.0	2.4	2.7	8.6
Palm kernel	2.6	3.3	.5	.4	(2)	(2)	.3
Peanut	(2)	(2)	(2)	1.1	1.1	.6	.6
Soya-bean	(2)	.5	5.1	9.3	1.1	.2	.3
Cottonseed foots	11.5	11.5	9.9	8.7	7.5	5.5	4.4
Miscellaneous	2.9	2.5	2.1	1.9	1.2	1.1	1.0
Total	47.2	48.1	48.0	47.3	38.9	35.0	41.4

Table IV.—Comparison of Consumption of Cottonseed Oils, Cottonseed Foots, and Soya-Bean Oil in Soaps, 1912-1923

	Cottonseed Oil		Cottonseed Foots		Soya-bean Oil	
Year	1,000 Pounds	Per Cent of Total Oils Used	1,000 Pounds	Per Cent of Total Oils Used	1,000 Pounds	Per Cent of Total Oils Used
1912	132,312	17.1	89,127	11.5	1,182	0.2
1914	119,254	12.7	108,141	11.6	4,499	.5
1916	194,916	17.3	112,178	9.9	57,373	5.1
1917	126,390	9.5	115,942	8.7	124,058	9.3
1919	56,130	6.0	108,389	12.0	58,401	6.0
1921	47,935	4.7	76,018	7.5	10,756	1.1
1922	19,759	1.7	61,966	5.5	2,307	.2
1923	10,824	.9	52,676	4.4	3,266	.3

Cottonseed oil in pre-war days was an important soap material, supplying (together with the foots) between 200 and 300 million pounds

annually, or 25 and 30 per cent of the total oils and fats consumed in the industry. After 1916 there was a steady decline in the utilization of cottonseed oil, until in 1923 it constituted less than 1 per cent of all oils and fats used in soap. The consumption of cottonseed oil and foots by the soap industry in 1923 was 63.5 million pounds, or less than 6 per cent of the total consumption of all oils and fats. Table IV gives comparative figures for cottonseed oil and foots and soya-bean oil used in the manufacture of soap.

The figures in Table IV indicate that since 1917 American soap makers have not found it practicable to replace soya-bean oil with cottonseed oil. The consumption of both has declined greatly since that year. The explanation is found in the rising price of cottonseed oil relative to other oils, which removes it from the soap-maker's market and restricts its use to edible products, such as lard compound.

In the last 12 years neither peanut oil nor corn oil has furnished as much as 1.5 per cent of all the oils used in soap making. The use of both of these oils for edible purposes has tended to remove them from the soap-maker's market.

STATISTICS OF FATS AND OILS

The Department of Commerce announces that the factory production of fats and oils (exclusive of refined oils and derivatives) during the three-month period ended June 30, 1926, was as follows: Vegetable oils, 416,508,975 pounds; fish oils, 8,149,876 pounds; animal fats, 542,465,032 pounds; and grease, 89,953,684 pounds; a total of 1,057,077,567 pounds. Of the several kinds of fats and oils covered by this inquiry, the greatest production, 415,930,980 pounds, appears for lard. Next in order is cottonseed oil with 162,999,207 pounds; linseed oil with 145,328,656 pounds; tallow with 124,197,159 pounds; coconut oil with 64,406,590 pounds and corn oil with 27,486,783 pounds.

The production of refined oils during the period was as follows: Cottonseed 190,113,979 pounds; coconut, 64,745,278 pounds; peanut, 1,936,828 pounds; corn 25,918,665 pounds; soya-bean, 2,366,810 pounds; and palm-kernel, 4,249,250 pounds. The quantity of crude oil used in the production of each of these refined oils is included in the figures of crude consumed.

The data for the factory production, factory consumption, imports, exports, and factory and warehouse stocks of fats and oils and for the raw materials used in the production of vegetable oils for the three-month period appear in the following statements:

Production, Consumption, and Stocks of Fats and Oils

(In some cases, where products were made by a continuous process, the intermediate products were not reported.)

	Factory operations for the quarter ending June 30, 1926		Factory and Warehouse stocks June 30, 1926 (pounds)
	Production (pounds)	Consumption (pounds)	
ANIMAL FATS:			
Lard, neutral	12,654,734	5,910,495	6,717,930
Lard, other edible	403,276,246	3,022,285	99,004,914
Tallow, edible	13,821,409	10,776,767	5,094,624
Tallow, inedible	110,375,750	132,457,433	85,866,687
Neat's-foot oil	2,336,893	1,313,633	1,496,554
GREASES:			
White	17,603,010	7,881,936	8,146,638
Yellow	16,091,992	15,571,951	9,743,061
Brown	9,602,017	6,574,077	6,943,789
Bone	5,648,643	147,777	2,317,658
Tankage	11,609,877	511,243	3,305,080
Garbage or house	21,026,727	19,676,189	9,488,503
Wool	1,238,197	1,354,756	2,172,902
Recovered	4,325,364	2,567,140	1,421,422
All other	2,807,857	2,266,007	2,001,219

	Factory operations for the quarter ending June 30, 1926		Factory and Warehouse stocks June 30, 1926 (pounds)
	Production (pounds)	Consumption (pounds)	
VEGETABLE OILS[1]			
Cottonseed, crude	162,999,207	237,748,067	15,406,020
Cottonseed, refined	190,113,979	248,364,167	191,741,402
Peanut, virgin and crude	3,093,372	2,332,077	1,063,006
Peanut, refined	1,936,828	1,973,638	1,110,742
Coconut, or copra, crude	64,406,590	105,151,692	65,796,487
Coconut, or copra, refined	64,745,278	57,749,740	12,372,145
Corn, crude	27,486,783	30,594,000	6,868,496
Corn, refined	25,918,665	7,246,302	11,065,480
Soya-bean, crude	873,902	5,517,420	4,965,232
Soya-bean, refined	2,366,810	2,048,426	2,429,061
Olive, edible	21,331	623,487	8,118,491
Olive, inedible	685	3,017,320	3,759,765
Sulphur oil, or olive foots	.....	9,438,247	8,230,607
Palm-kernel, crude	.....	32,844,911	12,796,219
Palm-kernel, refined	4,249,230	2,587,460	1,825,585
Rapeseed	89,180	3,623,570	3,624,596
Linseed	145,328,656	107,280,911	128,556,548
Chinese wood or tung	.....	22,448,035	19,890,464
Chinese vegetable tallow	.....	1,224,722	840,520
Castor	11,447,480	4,424,685	7,343,230
Palm	.....	28,486,691	28,632,733
All other	761,789	2,073,995	5,522,962
FISH OILS:[1]			
Cod and cod-liver	199,042	2,921,487	4,105,523
Menhaden	1,456,666	11,222,735	8,363,890
Whale	794,775	19,550,792	40,952,636
Herring, including sardine	5,438,978	1,780,955	5,875,054
Sperm	73,500	188,338	1,105,114
All other (including marine animal)	186,915	795,869	1,246,899
OTHER PRODUCTS:			
Lard compounds and other lard substitutes	270,660,445	107,960	15,532,643
Hydrogenated oils	100,374,291	99,402,003	13,640,924
Stearin, vegetable	1,122,198	3,018,695	1,661,188
Stearin, animal, edible	19,353,097	15,023,651	7,356,553
Stearin, animal, inedible	5,278,979	3,926,013	2,619,807
Oleo oil	43,967,498	11,655,642	13,717,570
Lard oil	6,411,466	4,397,057	4,309,208
Tallow oil	2,390,065	2,172,837	2,165,767
Fatty acids	34,642,020	42,243,531	4,959,097
Fatty acids, distilled	18,633,058	19,685,788	2,736,961
Red oil	12,818,111	5,073,122	7,389,825
Stearic acid	7,870,065	2,553,246	4,507 993
Glycerin, crude 80% basis	27,050,113	32,984,400	5,832,755
Glycerin, dynamite	12,106,681	8,848,174	8,674,023
Glycerin, chemically pure	16,187,692	1,501,520	5,400,138
Cottonseed foots, 50% basis	78,631,724	62,360,927	49,705,208
Cottonseed foots, distilled	33,320,828	47,361,604	7,071,319
Other vegetable oil foots	10,728,650	9,107,012	2,515,817
Other vegetable oil foots, distilled	702,292	117,815	326,089
Acidulated soap stock	26,109,979	22,426,044	25,189,902
Miscellaneous soap stock	1,159,369	1,330,140	229,680

[1] The data of oils produced, consumed and on hand by fish oil producers and fish canners were collected by the Bureau of Fisheries.

Raw Materials Used in the Manufacture of Vegetable Oils

Kind	Consumed Mar. 31 to June 30	On hand June 30	Kind	Consumed Mar. 31 to June 30	On hand June 30
Cottonseed	524,037	39,240	Corn germs	51,291	338
Peanuts, hulled	3,108	654	Flaxseed	217,916	73,103
Peanuts in the hull	672	215	Castor beans	12,795	4,749
Copra	49,771	15,278	Mustard seed	471	1,202
Coconuts and skins	1,177	302	Soya-beans	3,725	188
Rape seed	130	....	Olives	76	....
			Other kinds	1,792	550

Imports of Oil Seeds, Quarter Ending June 30, 1926

Kind	Tons	Kind	Tons
Cotton seed	2,946	Poppy seed	222
Castor beans	12,444	Perilla and sesame seed	245
Copra	55,498	Other oil seeds	1,571
Flaxseed	161,127		

Imports of Foreign Fats and Oils, Quarter Ending June 30, 1926

Kind	Pounds	Kind	Pounds
Whale oil	42,392,362	Palm-kernel oil	31,751,820
Cod and cod-liver	6,516,825	Peanut oil	1,016,865
Other fish oils	1,064,055	Rape oil	1,984,695
Beef and hog fats	5,536,690	Linseed oil	10,164,773
Wool grease	2,292,716	Sesame oil	1,198,784
Grease and oils, n. e. s. (value)	$226,759	Soya-bean oil	8,272,130
Chinese wood oil or nut oil	10,272,940	Vegetable tallow	1,471,955
Coconut oil	50,517,053	Vegetable wax	2,347,362
Olive oil, edible	24,059,726	Other vegetable oils	3,943,885
Sulphur oil, or olive foots	12,760,051	Glycerin, crude	4,028,090
Olive oil, denatured	3,958,373	Glycerin, refined	1,353,167
Palm oil	38,667,056		

Exports of Foreign Fats and Oils, Quarter Ending June 30, 1926

Kind	Pounds	Kind	Pounds
Beef and hog fats	2,602	Olive oil, edible	14,112
Fish oils	68,352	Palm & Palm-kernel oil	660,107
Other animal oils, fats and greases	57,713	Peanut oil	17,376
Chinese nut oil	1,740,612	Soya-bean oil	15,600
Coconut oil	950,212	Other vegetable oils	309,031
		Vegetable wax	193,456

Exports of Domestic Fats and Oils, Quarter Ending June 30, 1926

Kind	Pounds	Kind	Pounds
Oleo oil	28,504,854	Stearic acid	180,390
Neat's-foot oil	278,199	Other animal greases, oils and fats	16,871,557
Other animal oils	141,832	Coconut oil	3,067,641
Fish oils	154,286	Cottonseed oil, crude	5,019,138
Oleo stock	5,043,619	Cottonseed oil, refined	1,343,861
Tallow	3,041,651	Linseed oil	632,510
Lard	177,796,073	Soya-bean oil	67,969
Lard, neutral	4,603,880	Corn oil	539,743
Lard compound, containing animal fats	1,509,751	Vegetable oil lard compound	1,454,460
Oleo and lard stearin	2,203,092	Vegetable soap stock	4,206,099
Grease stearin	948,530	Other vegetable oils and fats	2,404,510
Oleic acid, or red oil	422,023	Glycerin	166,098

Domestic Exports of Lard Compounds and Oleomargarine, from the United States During June

Countries	Lard compounds containing animal fats		Oleomargarine of animal or vegetable fats		Vegetable oil lard compounds	
	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars
Italy	.....	.....	.....	....	3,178	494
United Kingdom	1,400	252	.....	....	.....	.....
Canada	1,180	204	200	24	3,558	564
British Honduras	12,748	2,128	100	20	351	70
Costa Rica	.....	.....	.....	....	864	178
Guatemala	2,352	390	.....	....	3,190	633
Honduras	1,188	242	.....	....	6,019	1,239
Nicaragua	10,924	1,725	.....	....	2,160	398
Panama	11,300	1,773	30,260	5,474	5,378	1,057
Salvador	.....	.....	.....	....	840	162
Mexico	31,265	5,081	1,096	247	92,629	14,537
Newfdld. and Labrador	1,200	104	.....	....	10,187	1,758
Bermuda	720	106	300	60	1,284	250
Jamaica	2,854	493	.....	....	9,980	2,161
Trinidad and Tobago	2,800	420	.....	....	540	116
Other British W. Indies	13,417	2,386	1,860	368	23,501	3,932
Cuba	165,284	43,271	400	80	101,498	15,740
Dominican Republic	250	40	500	106	325	54
Dutch West Indies	23,950	3,846	.....	....	.....	.....
Haitian Republic	58,103	10,737	.....	....	10,100	2,122
Virgin Is. of U. S.	15,723	2,374	3,875	727	240	56
Chile	8,500	1,403	.....	....	336	67
Colombia	.....	.....	.....	....	180	39
Ecuador	1,000	200	.....	....	40,741	5,746
Dutch Guiana	100	15	.....	....	.....	.....
Venezuela	250	45	.....	....	.....	.....
British India	.....	.....	.....	....	788	138
China	5,400	1,324	.....	....	3,456	790
Java and Madura	.....	.....	.....	....	1,060	224
Hongkong	.....	.....	.....	....	1,920	483
Japan, including Chosen	.....	.....	.....	....	23,030	4,351
Kwangtung, leased territory	.....	.....	.....	....	72	16
Philippine Islands	.....	.....	.....	....	3,600	760
Siam	.....	.....	.....	....	72	17
Syria	.....	.....	.....	....	192	30
Other Asia	.....	.....	.....	....	324	72
Australia	784	125	.....	....	3,265	523
British Oceania	.....	.....	.....	....	610	90
French Oceania	.....	.....	.....	....	364	76
New Zealand	.....	.....	.....	....	3,550	571
British West Africa	3,812	614	.....	....	.....	.....
Other Port. Africa	.....	.....	.....	....	728	138
Alaska	5,154	727	.....	....	.....	.....
Hawaii	82,945	12,318	.....	....	.....	.....
Porto Rico	51,538	7,834	.....	....	.....	.....
Total	516,141	100,177	38,591	7,106	360,110	59,658

Domestic Exports of Oleo Oil, Tallow, Oleic Acid or Red Oil, and Other Animal Greases, Oils and Fats, N. E. S., During June

Countries	Oleo oil Pounds	Tallow Pounds	Oleic acid or red oil Pounds	Other animal greases oils and fats, n.e.s. Pounds
Belgium	177,940	.....	.....	954,576
Denmark and Faroe Islands	494,097	.....	4,546	.....
Germany	3,869,032	.....	.....	16,340
Greece	265,174	.....	.....	.....
Italy	68,872	.....	.....	28,023
Netherlands	2,895,887	.....	.....	2,440,873
Norway	433,322	.....	.....	1,914
Poland and Danzig	7,875	.....	44,074	.....
Sweden	40,000	.....	.....	2,023
United Kingdom	1,287,370	613,929	.....	135,224
Canada	.....	62,860	47,345	886,565
Costa Rica	.....	5,088	.....	61,715
Guatemala	.....	.....	.....	130,636
Honduras	.....	225	.....	9,100
Nicaragua	.....	.....	.....	105,100
Panama	.....	2,376	.....	.....
Salvador	.....	9,500	.....	.....
Greenland	1,938	589,984	80,235	601,782
Newfoundland and Labrador	40,000	.....	.....	.....
Jamaica	500	.....	.....	.....
Other British W. Indies	150	.....	.....	.....
Cuba	67,371	69,544	.....	1,086,190
Dominican Republic	.....	61,196	.....	20,700
Haitian Republic	.....	100	.....	.....
Brazil	.....	1,200	.....	.....
Colombia	.....	.....	.....	46,650
Hongkong	.....	.....	.....	4,000
Japan, including Chosen	4,000	.....	.....	.....
Palestine	.....	.....	.....	545
Philippine Islands	.....	.....	.....	13,780
Syria	13,776	.....	.....	.....
New Zealand	.....	.....	.....	593
British S. Africa	.....	.....	.....	200
Total—Quantity	9,667,304	1,416,002	176,200	6,546,529
Total—Value	1,246,324	130,811	15,586	652,206

Domestic Exports of Vegetable Oils, Expressed, from the United States During June

Countries	(Cottonsetd Oil) Crude Pounds	(Cottonsetd Oil) Refined Pounds	Corn oil Pounds	Cocoa butter Pounds	Coconut oil Pounds	Linseed oil Pounds	Soy-bean oil Pounds
United Kingdom	.....	.....	.....	....	.....	405	....
Canada	235,080	47,367	8,450	61,195	67,643	29,192	970
British Honduras	.....	197	.....	36	.....	.....	....
Costa Rica	.....	820	6,360	....	14,400	375	....
Guatemala	.....	458	12,846	....	2,840	4,500	....
Honduras	.....	2,545	.....	....	.....	14,582	....
Nicaragua	.....	1,398	.....	....	34,450	2,469	....
Panama	.....	4,860	.....	48	.....	392	....
Salvador	.....	4,215	750	216	16,960	.....	....
Mexico	4,000	29,890	407	472	836,827	28,416	....
Bermuda	.....	561	.....	....	.....	187	....
Other Brit. W. Indies	.....	195	.....	....	.....	533	....
Cuba	.....	87,722	45,045	....	13,084	27,904	....
Dominican Republic	.....	7,446	11,850	....	.....	.....	190
Dutch West Indies	.....	6,675	2,625	....	.....	120	....
French West Indies	.....	1,810	.....	....	.....	75	....
Haitian Republic	.....	75	1,287	....	.....	4,666	....
Virgin Is. of U. S.	.....	955	.....	....	.....	403	....
Bolivia	.....	.....	.....	....	.....	361	....
Brazil	.....	.....	.....	....	.....	1,611	....
Chile	.....	1,268	.....	....	15,196	12,600	....
Colombia	.....	3,542	6,420	308	3,000	15,859	....
Ecuador	.....	.....	.....	200	.....	225	....
Dutch Guiana	.....	2,245	240	....	.....	.....	....
Peru	.....	145	.....	121	.....	.....	....
Venezuela	.....	.....	4,260	....	.....	11,928	....
British India	.....	84	.....	....	.....	.....	....
Ceylon	.....	628	.....	....	.....	.....	....
China	.....	20,636	.....	....	1,048	.....	....
Hongkong	.....	1,158	.....	72	.....	.....	....
Japan, including Chosen	.....	61,334	.....	....	10,000	.....	....
Kwangtung, leased terr.	.....	840	.....	....	.....	.....	....
Philippine Islands	.....	29,170	.....	1,000	.....	.....	....
Other Asia	.....	450	.....	....	.....	.....	....
Australia	.....	.....	.....	....	.....	1,775	....
British Oceania	.....	.....	.....	....	233	.....	....
French Oceania	.....	120	.....	....	.....	610	....
New Zealand	.....	11,250	5,400	....	7,400	25	....
British S. Africa	.....	.....	33,426	....	.....	.....	....
Total—Quantities	239,080	329,969	139,366	63,658	1,022,081	159,213	1,160
Total—Values	17,683	54,681	21,153	21,124	96,193	20,378	159

Shipments from the United States to non-contiguous territories

	Oils, Expressed			
	Cottonseed		Linseed	
	Pounds	Dollars	Pounds	Dollars
Alaska	1,250	167	16,557	2,014
Hawaii	14,236	2,595	7,666	1,035
Porto Rico	10,639	1,772	44,055	5,131

IMPORTS OF OLIVES, COCONUT MEAT AND OIL, PEANUTS AND OIL, AND EDIBLE OLIVE OIL DURING MAY

Countries	Olives in brine		Coconut meat, dessicated, shredded, cut, etc.		Copra	
	Gallons	Dollars	Pounds	Dollars	Pounds	Dollars
France	286	424	.....	.....	.....	.....
Greece	46,808	22,486	5,200	526	.....	.....
Italy	14,656	6,300	.....	.....	.....	.....
Portugal	890	543	.....	.....	.....	.....
Spain	756,600	569,488	.....	.....	.....	.....
Canada	4,752	3,880	.....	.....	30,969	1,768
British Honduras	.....	.....	.....	.....	102,450	5,267
Honduras	.....	.....	.....	.....	72,257	2,962
Nicaragua	.....	.....	.....	.....	1,960	88
Panama	.....	.....	.....	.....	8,100	427
Jamaica	.....	.....	.....	.....	345,494	17,549
British Malaya	.....	.....	.....	.....	4,354,567	226,158
Ceylon	.....	.....	1,095,160	84,343	.....	.....
China	334	255	.....	.....	.....	.....
Hongkong	448	390	.....	.....	.....	.....
Philippine Islands	.....	.....	2,866,156	282,008	25,092,395	1,303,033
Syria	202	194	.....	.....	.....	.....
Australia	.....	.....	.....	.....	137,705	6,944
British Oceania	.....	.....	.....	.....	2,699,807	151,140
French Oceania	.....	.....	.....	.....	2,830,194	149,602
British E. Africa	.....	.....	.....	.....	2,516,861	118,156
Total	824,976	603,960	3,966,516	366,877	38,192,759	1,983,094

Countries	Coconut oil		Peanuts			
			Shelled		Not shelled	
	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars
Germany	.....	.....	11,067	902	.....	.....
Netherlands	.....	.....	2,756	273	.....	.....
Dutch West Indies	.....	.....	.....	.....	1,045	74
China	.....	.....	9,508,174	437,592	453,565	19,928
Hongkong	.....	.....	200	18	5,868	734
Japan, including Chosen	.....	.....	250	25	15,090	930
Philippine Islands	16,083,747	1,520,931	.....	.....	.....	.....
Total	16,083,747	1,520,931	9,522,447	438,810	475,568	21,666

Countries	Peanut oil		Olive Oil, Edible			
			In packages less than 40 pounds		Other	
	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars
France	176	41	127,269	29,545	135,023	22,221
Italy	.....	.....	3,989,241	694,964	765,241	142,471
Netherlands	1,926	236	.....	.....	.....	.....
Portugal	.....	.....	3,720	390	.....	.....
Spain	.....	.....	509,940	84,314	1,996,180	325,256
China	3,600	408	.....	.....	.....	.....
Hongkong	174,812	22,269	.....	.....	.....	.....
Japan, including Chosen	2,140	248	.....	.....	.....	.....
Syria	.....	.....	.....	.....	2,600	373
Algeria and Tunisia	.....	.....	.....	.....	220,412	40,858
Total	182,654	23,202	4,630,170	809,213	3,121,546	531,179

ABSTRACTS

Polymerisation of Fatty Oils. V. J. Marcusson (Z. angew. Chem., 1926, 476-478; cf. B., 1925, 889). Linseed oil films contain about 55 per cent of solid polymerised and oxidised gel and 40 per cent of polymerised and oxidised sol with 5 per cent unchanged oil. Poppyseed oil films contain 51 per cent of insoluble gel (mol. wt. 707), 31 per cent of easily gelatinesed sol containing 40 per cent of unpolymerised fatty acids and a variable amount of acids of mol. wt. 420, and 18 per cent of unchanged oil. The acetone-insoluble gel of tung oil films (83 percent) contains a unimolecular, oily product soluble in furfuraldehyde and having a mol. wt. of over 100 by Rast's camphor method. During the drying of tung oil, isomerisation due to the action of light first takes place, followed by polymerisation and oxidation. The halogens and sulphur have a similar action to light in that at 10° they precipitate B-elaeostearin and at room temperature a solid polymerisation product. For the detection of tung oil in mixtures 5 g. of the oil are shaken with 5 c. c. of a cold saturated solution of iodine in chloroform; with high percentages of tung oil a gelatinous mass is obtained but with 15-20 per cent of tung oil the mixture must be warmed on the water-bath. No other fatty oil behaves similarly. A rough quantitative test may be made by extracting the reaction product with chloroform in Graefe's apparatus, removing the iodine by shaking with thiosulphate, distilling off the chloroform, drying, and weighing.

Action of Sulphur on Linseed Oil. G. S. Whitby and H. D. Chataway (J.S.C.I., 1926, **45**, 115-121T.). To samples of 20 g. of raw linseed oil definite amounts of sulphur up to 16.5 per cent were added with agitation and exclusion of air, and at temperatures maintained accurately at 160° (or 170° in some cases), samples being withdrawn at intervals prior to setting and the amount of acetone-insoluble fraction determined. In all cases after heating for 45 min. at 160° all the sulphur added had combined with the oil. Results are given for time of setting and for the concentration of acetone-insoluble material at the moment of gelation. The proportion of sulphur in combination with the oil was always higher in an acetone-insoluble than in a corresponding acetone-soluble fraction. In the action of sulphur and heat on drying oils three well-defined stages succeed each other, viz., chemical combination of sulphur with the oil which takes place comparatively quickly, followed by the formation of an acetone-insoluble product in the second stage, a gradually increasing proportion of the oil changing to a more viscous liquid insoluble in cold acetone. This change is apparently polymerisation, the speed of which is greater, the greater the amount of sulphur present and the higher the temperature. Finally, gelation takes place, and it is presumed that during heating the acetone-insoluble material gradually assumes colloidal dimensions and this colloidal material imbibes the acetone-soluble liquid and any portion of the acetone-insoluble liquid still non-colloidal and a gel then appears rather suddenly. The closely related phenomena of the "drying" of oils and of their thickening under the influence of heat are shown to be similar to the setting of oils under the influence of sulphur and heat.

Effect of "Blowing" on the Composition of Certain Fatty Oils. C. H. Thomson (Analyst, 1926, **51**, 177-180). The effect of "blowing" at different stages has been examined in the case of cotton seed, whale, sperm, and shark oils, the oils being treated on the large scale, in quantities of about 4 tons, at 115°. Samples were taken at different stages and the specific gravity, viscosity at 93°

(Redwood), and the usual constants and variables were determined. Methylated ether was the solvent used to extract the unsaponifiable matter. Tabulated results indicate that iodine value and unsaponifiable matter fall during the oxidation, while specific gravity, viscosity, saponification value refractive index, and free fatty acids (as oleic) rise to a greater or less extent. Although the constants and variables rise or fall simultaneously at each stage they do so at the same rate. The rise in saponification value is concurrent with the fall in unsaponifiable matter, the increase in acid value being apparently partly due to the oxidation of the unsaponifiable alcohols to fatty acids. Ether-insoluble bromides are not produced from blown shark, whale, or sperm oils, though they are given by the untreated oils. There is practically a regular rise in the viscosity and refractive index after the oil reaches a viscosity of 700 sec., and up to 1800 sec., but below 700 sec. the relationship is irregular. The various changes caused by "blowing" are brought out clearly in a table giving the analysis of the saponified oils. The amount of glycerol produced is not affected but a considerable quantity of apparently neutral organic matter is formed. Similarity in conditions of blowing must be observed to obtain similar results—the changes in composition are in the same direction as the blowing is continued. In the case of sperm oil blowing was also carried out with the addition of 0.1 per cent of cobalt oxide and certain anomalies were noted.

Chemical Reactions in Fat Hardening. W. Normann (Z. Deuts. Oel-u, Fett-Ind., 1926, **46**, 193-195). Mainly a discussion of the general reactions involved and the behaviour of the nickel-kieselguhr catalyst. Graphs are given for a number of oils showing the progress and completion of hardening, the fall in iodine value and corresponding rise in m.p., and also the fall in iodine value together with progressive fall in refractive index (Zeiss butyrorefractometer). For judging the progress of hardening in a particular case the determination at intervals of the refractive index of the oil is the quickest and is better than a method involving the measurement of the amount of hydrogen consumed. An accompanying table shows the amount of hydrogen in cub. m. at 0° and at 20° required to saturate completely 1000 kg. of the commoner fatty acids and fatty oils. In practice oils are seldom hardened till completely saturated. Owing to loss of hydrogen and to side reactions the amount of hydrogen consumed in a particular hardening is in practice 10-20 per cent in excess of the amount as calculated from the fall in the iodine value.

Vitamin A in "Oleo Oil" and Oleostearine. R. Hoagland and G. G. Snider (J. Agric. Res., 1926, **32**, 397-416). Oleo oil (expressed from premier just at about 90° F.) is usually graded as No. 1, No. 2, No. 3, and yellow oil, the last of which is prepared from fats derived from grass-fed cattle. The results are reported of a study of vitamin A content of 24 samples of oleo oil and 8 samples of oleostearine, collected from various commercial meal-packing plants. The vitamin A content of each sample was determined by feeding tests with young albino rats, the oil or stearine being the only known source of this vitamin in an otherwise adequate ration. In general, the yellow oleo oil was much the richest vitamin A; No. 2, No. 3 and mutton oleo oil had approximately the same value; and No. 1 oleo was the poorest in vitamin A. Similarly, each sample of yellow "stearine" was richer in this vitamin than any sample of the other grades of oleostearine. Although the yellow oleo was richer in vitamin A than the other lighter coloured grades, there appeared to be no constant relation between the colour of an oil and its vitamin content. Thus, the mutton oleo oil, dead white in colour, was richer in vitamin A than the light yellow No. 1 oleo oil, and approximately as rich in it as the medium-yellow No. 2 and No. 3 oils. "Oleo oil" ranks below butter, but ahead of lard and the vegetable fats and oils, as a source of vitamin A.—P. H. P.